REMARKS

Upon entry of the instant amendment, Claims 3, 4, 7, 10, 11, 14, 15 and 21-24 are pending. Claims 1, 2, 5, 6, 8, 9, 12, 13 and 16-20 have been cancelled. Claims 3, 11, 15, 22 and 23 have been amended to more particularly point out the Applicant's invention. It is respectfully submitted that upon entry of the Amendment, the application is in condition for allowance.

CLAIM OBJECTIONS

Claims 2 and 9 have been cancelled. Thus, the objection of these claims is obviated. With respect to Claim 23, this Claim has been amended to overcome the antecedent basis objection. Thus, the Examiner is respectfully requested to reconsider and withdraw the Claim objections.

CLAIM REJECTIONS-35 USC § 102

Claims 2-5, 9, 11, 15, 22 and 23 have been rejected under 35 USC § 102 (b) as being anticipated by Avigor CH 207,150. In order for there to be anticipation, each and every one of the claim elements must be found in a single reference. It is respectfully submitted that the Claims, as amended, recite elements, not disclosed or suggested by the Avigor CH 207,150 reference. In particular, the claims have been amended to recite that shell and the pump-motor assembly are configured to pump the fluid in which the pump-motor assembly is immersed through the "cavity" defined between the shell and the pump-motor assembly. An English translation of the Avigor CH 207,150 reference is attached. As shown in Fig. 1 and clearly indicated on page 2 of the translation of the Avigor CH 207,150 reference, a "connecting tube 11" surrounds the motor 2. The "cavity" between the motor 11 and the connecting tube 11 is filled with a fluid with a relatively high specific gravity in order to prevent the fluid in which the pump-motor assembly is immersed from seeping into the motor housing. As shown in Fig. 2 of the Avigor CH 207,150 reference, a cavity is defined between a "casing" which surrounds the motor 19 and an annular housing or shell identified with the reference numeral 25. However, the

Avigor CH 207,150 reference does not disclose or suggest a cavity formed as an expanded portion relative to the motor unit. It is clear that the Avigor CH 207,150 reference teaches a configuration in which annular space adjacent the motor unit is not used for pumping the fluid in which the pump-motor unit is immersed. Stated another way, the Avigor CH 207,150 reference teaches away from a shell surrounding the pump-motor unit which defines a cavity between the pump-motor unit and is used for pumping the fluid in which the pump-motor assembly is immersed. Thus, it is respectfully submitted that not only does the Avigor CH 207,150 reference not anticipate claims; it actually teaches away from the invention. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejection.

Claims 2-5, 9 and 11 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Smerud, et al., U.S. Patent No. 6,000,917. In order for there to be anticipation, each and every one of the elements of the claims must be found in a single reference. It is respectfully submitted that the claims, as amended, recite subject matter that it is not disclosed or suggested by the Smerud, et al. patent. For example, the claims now recite a sealed motor unit, wherein the motor has a motor housing. The Smerud, et al. patent does not disclose or suggest a sealed motor, and relies on the hermetic shell 11 of the combination motor compressor. The Smerud, et al. patent discloses an integrally-formed motor compressor unit in which the motor is not sealed or provided with a separate housing ("Such oil is directed into an oil return passage that is at least partially defined by the stator of the compressor drive motor and the compressor shell", column 3, lines 6-8). As such, failure of the motor normally requires replacement of the entire unit. For all of the above reasons, it is respectfully submitted that the Smerud, et al. patent does not disclose or suggest the claims as recited in the claims at issue. Accordingly, the Examiner is respectfully requested to reconsider and withdraw this rejection.

Claims 2-5, 9 and 11 have also been rejected under 35 U.S.C. § 102(b) as being anticipated by Beardmore, U.S. Patent No. 4,571,159. The Beardmore patent, like the Smerud,

et al. patent, also discloses the use of an integrally-formed pump motor unit in which the motor does not have a separate housing. As mentioned above, the claims have been amended to recite that the motor unit is a sealed unit. As such, there can be no anticipation. As mentioned above, the configuration as recited in the claims facilitates replacement of the motor unit without requiring the entire pump motor unit to be replaced. For these reasons and all of the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection under 35 U.S.C. § 102.

CLAIM REJECTIONS – 35 U.S.C. § 103

Claims 7, 14, 21 and 24 have been rejected under 35 USC § 103(a) as being unpatentable over the Avigor CH 207,150 reference. As mentioned above, the Avigor CH 207,150 reference actually teaches away from the claimed invention. For these reasons and the reasons stated above, the Examiner is respectfully requested to reconsider and withdraw the rejection.

Respectfully submitted,

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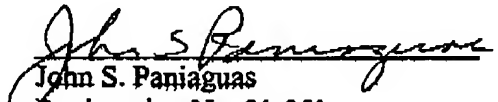
By: 
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SWISS CONFEDERATION
FEDERAL OFFICE FOR INTELLECTUAL PROPERTY
PATENT NO. 207150
MAIN PATENT

Class:	125c
Application Filed:	November 4, 1938, 6:30 pm
Patent Registered:	September 30, 1939
Published:	December 16, 1939

CONVEYING DEVICE FOR LIQUID FUELS

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Inventor:	Rifat Avigdor

It has already been proposed that the electric motor of devices for pumping liquid fuel be arranged in the fuel tank itself, in particular, such that is operates below the surface of the fuel in the manner of a deep-well pump or a submersible pump. However, it is not practicable to seal the housing enclosing the electric motor well enough so that no fuel will penetrate the housing even after long term operation. Liquid hydrocarbons such as gasoline have the property of penetrating through the narrowest gaps and openings,

The invention pertains to a conveying device for liquid fuels with an electric motor, enclosed below the surface in a sealed housing, for driving a fuel conveying pump. With the conveying device of the invention the aforementioned difficulties are alleviated in that the housing is filled with oil under a pressure higher than the pressure of the liquid fuel surrounding the housing. It is expedient to select oils that do not mix with liquid fuel such as gasoline, or do so only with difficulty. Castor oil, for instance, is suitable for this purpose. The oil present in the housing can then be kept under static pressure by a liquid column, with no pump systems or the like being required to maintain the pressure in the liquid filling the housing. Liquid or even gaseous substances can of course not penetrate into the housing so long as the pressure inside the housing is higher than that on the outside.

Some embodiments of the object of the invention are illustrated in the drawing.

Figure 1 schematically shows a vertical section through the first embodiment;

Figure 2 is a vertical section through a second embodiment;

Figure 3 is a longitudinal section along line III – III in Figure 4 of the electric motor used in the conveying device;

Figure 4 is a cross section along line IV – IV in Figure 3; and

Figure 5 is a schematic representation of a conveying device according to the invention together with a stationary system for dispensing liquid fuel.

The fuel conveying device of Figure 1 possesses a pump 1 that is directly coupled to an electric motor 2 and is situated inside tank 3 filled with fuel. The electric motor thus lies below the fuel surface in tank 3. Pump 1 lies at the lowest part of the tank. The fuel flows through suction pipe 4 of pump 1 and is conveyed through pressure pipe 5 with attached pressure line 6 to the desired point. Pump shaft 7 is sealed outside the pump housing by a lip seal 8 in an intermediate chamber 9. The construction of the pump is such that the pump shaft is always on the suction side of the pump when the latter is operating so that the lip seal 8 is under suction and enhances the sealing effect further. Electric motor 2 is arranged above pump 1 and is encapsulated as tightly as possible. The motor shaft, which is simultaneously the pump shaft in the illustrated example, is sealed against the exterior by a lip seal 10 at the passage through the motor housing. This lip seal 10 also lies inside intermediate chamber 9 where lip seal 8 is also situated. Intermediate chamber 9 is formed of pump housing 1, electric motor 2 and connecting tube 11. Pump housing 1 is screwed firmly and tightly to connecting tube 11. Connecting tube 11 forms the housing for motor 2. Connecting tube 11 is screwed firmly and tightly to the lid of tank 3. Electrical supply lines 12 for motor 2 run to the outside sealed through the motor housing via passage holes of connecting tube 11. Between the interior wall of connecting tube 11 and the exterior wall of electric motor 2, there are channels 13 that form a connection between intermediate chamber 8 and upper space 14 of connecting tube 11. Connecting tube 11 is filled to the top with an oil insoluble in the fuel, so that intermediate chamber 9 is completely filled with the oil through channels 13. The composition of the oil for filling the connecting tube is selected such that its specific gravity is higher than that of the respective fuel. Since the height of the connecting tube is roughly equal to the depth of the tank, the static pressure at lip seal 8 for the passage hole of the pump shaft is then directed towards the pump, even in case of a tank completely filled with fuel, so that fuel can never enter intermediate chamber 9. Due to the lip seal and the oil filling of the intermediate chamber, no fuel vapors can reach the electric motor, since a gas-tight seal at the pump or motor shaft is achieved.

Because electrical lines 12 of electric motor 2 are moved into the oil filling, the risk of explosion or ignition in connecting tube 11 in case of any violent intrusions (e.g., by projectiles) are avoided or sharply reduced.

Connecting tube 11 has a filling opening through with the respective fill level can be checked and oil can be added if needed.

In Figure 2, 15 labels a supply tank for fuel 16. 17 is the filling opening. At a suitable place in the tank, or in the center, there is suspended a casing 18, near the bottom of which, below the surface of fuel 16, is situated electric motor 19 driving centrifugal pump 21 by way of a shaft 20. A lip seal 22 serves to seal off the housing in which the electric motor is housed. An additional lip seal 23, which likewise surrounds shaft 20, closes off the casing area towards centrifugal pump 21 and thus towards the fuel 16 in tank 15. Casing 18, as already indicated, is filled with oil. Again, an oil with a higher specific gravity than that of the fuel is selected so that the static pressure of the oil at lip seal 23 is always higher than the pressure of the liquid fuel. Electric motor 19, together with its housing, runs along the casing wall in a suitable manner, via ribs for example, so that oil has free passage into the area between the centrifugal pump and electric motor 19. The inlet opening for fuel into centrifugal pump 21 is labeled 24.

Pressure line 25, through which the fuel is conveyed, surrounds casing 18 annularly, as the figure indicates. The power for the electric motor is supplied through the two lines 26. A top part 27 that is closed off by a bolt 28 is inserted into the mouth of the casing. The condition of the oil and the oil level in the casing can be controlled by removing bolt 28. Annular pressure line 25 issues into an outlet connector 29 on top part 27. A wall 30 in top part 27 closes off the interior of connector 29, and thus pressure line 25, from the remainder of the interior of top part 27, which has another connector 31 on the opposite side, through which electrical supply lines 26 are run.

As the drawing indicates, top part 27, together with casing 18, electric motor 19 and conveying pump 21, can be removed as unit from tank 15 in order, for instance, to be maintained or replaced by another unit.

In Figures 3 and 4, the electric motor serving to drive pump 33 is labeled 32. The housing of electric motor 32 is provided with threads at position 34 in order to screw the electric motor into installation housing 35. Installation housing is again connected to a tube suspension piece 36 fastened, for instance, to the lid of the tank. The submersible pump assembly is located in the interior of the liquid-filled tank and has the purpose of conveying the liquid to a consumption point. The housing of electric motor 32 is provided with broad ribs 37. Channels 38 remain between these ribs. Installation housing 35 is furnished in the same manner with ribs 39 and channel spaces 40 between them. Ribs 37 and 39 as well as channels 38 and 40 are aligned, i.e., they lie on a straight line when the housing of the electric motor is screwed in, as shown in Figure 3.

A metal sleeve 41 is pushed onto the housing of electric motor 32. This metal sleeve contacts all faces of ribs 37 and has a length such that it also covers installation housing 35, i.e.,

has a snug fit with ribs 39. The upper part of the sleeve is additionally in metallic contact with the upper part of the installation housing, as shown in Figure 3.

The heat developed by the electric motor is carried off by ribs 37 to sleeve 41 and then conducted by the sleeve to the installation housing and dissipated. In this manner, there is an efficient cooling of the electric motor.

The pressurized protective oil is situated in channels 38 defined by ribs 37 and sleeve 41. The entire submersible pump assembly is surrounded by still another tube 42 which terminates at its lower end in a suction chamber 43 for pump 33. This tube 42 lies a certain distance away from sleeve 41, so that an annular space 43a results that forms the pressure line for the conveyed liquid.

In Figure 5, the underground part of the filling station tank is labeled 67, while 68 represents the tank's dispensing pump. Submersible pump assembly 69, which has an electric motor enclosed in a housing and a pressure pump and can be designed similarly to that which is shown in Figure 2, is situated inside the tank. The housing of submersible pump assembly is filled with oil. Submersible pump assembly 69 is preferably connected by tubes 70 inserted one inside the other to a top part 71 seated on tank 67. Two tubes 72 and 73 are connected to the top part. Tube 72 leads from the pressure pump to tap point 74 in the filling pump in order to dispense fuel. Tube 73 likewise terminates at point 75 in the filling pump, but above tap point 74. The upper part 75 of tube 73 is formed by a glass tube or the like. The protective oil filling of submersible pump assembly 69 continues uninterruptedly through tube 73 into transparent upper tube part 75. The static pressure level of the oil is thus greater than the static pressure level of the fuel, whereby the advantages mentioned above are achieved.

Patent Claim

Conveying device for liquid fuels with an electric motor for driving a fuel conveying pump enclosed below the surface in a housing sealed against the exterior, characterized in that the housing is filled with oil that is under a pressure which is higher than the liquid fuel surrounding the housing.

Subordinate Claims

1. Conveying device according to the Patent Claim, characterized in that the housing surrounding the electric motor bears the fuel conveying pump at its lower end.

2. Conveying device according to Subordinate Claim 1, characterized in that the housing forming a casing (18) penetrates vertically through a fuel tank (15), is suspended from the lid, and reaches approximately to the tank bottom.

3. Conveying device according to Subordinate Claim 1, characterized in that fuel conveying pump (21) is a centrifugal pump.

4. Conveying device according to Subordinate Claim 1, characterized in that the seal for the pump shaft is a lip seal (23) which is arranged such that the sealing effect is reinforced by the suction occurring when the pump is running.

5. Conveying device according to Subordinate Claim 2, characterized in that pressure line (25) of the fuel conveying pump is an annular channel surrounding casing (18).

6. Conveying device according to Subordinate Claim 2, characterized in that supply lines (26) to electric motor (19) are led out upwards through the oil filling present in the casing.

7. Conveying device according to Subordinate Claim 2, characterized in that the casing, together with the electric motor and the fuel conveying pump, can be removed from the tank as one assembly.

8. Conveying device according to Subordinate Claim 6, characterized in that a top part (27), having a connector (29) for the conveyed liquid, a closable opening (28) for monitoring the filling liquid in the casing, and an inlet connector (31) for the supply line of the electric motor, is inserted from above into the upper end of the casing.

9. Conveying device according to Subordinate Claim 1, characterized in that motor housing (32) comprises longitudinal ribs (37), and in that a metal sleeve (41), which extends beyond the motor housing in metallic contact with an installation housing (35) of the submersible pump assembly, is seated on the [motor] housing with a snug fit.

10. Conveying device according to Subordinate Claim 9, characterized in that installation housing (35) is likewise furnished on its exterior side with ribs (39) that are aligned with ribs (37) of the motor housing, in that heat-dissipating metal sleeve (41) is in a snug fit with rib faces (39) of installation housing (35), and in that channels (38, 40) between the ribs of the two housings contain the protective oil.

11. Conveying device according to Subordinate Claim 10, characterized in that heat-dissipating sleeve (41) is surrounded at a distance by a tube (42) that is constructed at its lower end as a suction chamber (43) for pump (33), and the annular space (44) formed between sleeve and tube forms the pressure line for the fuel conveyed by the pump.

12. Conveying device according to Subordinate Claim 1 on a fuel tank connected to a filling station, characterized in that the oil column of the submersible pump assembly is run into the filling pillar and the oil level is made visible from the outside.

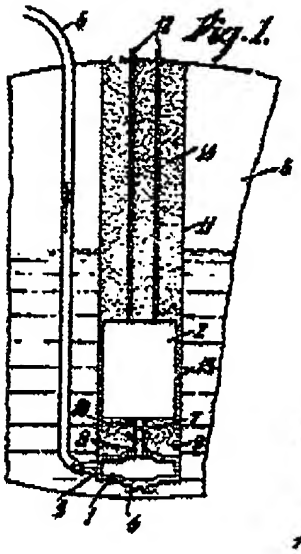


Fig. 1.

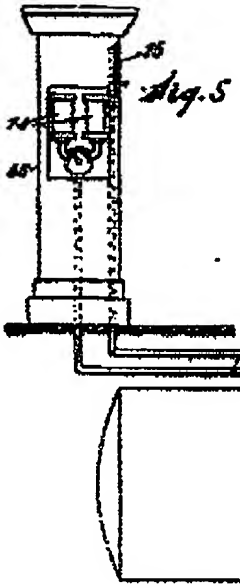


Fig. 5

Fig. 4.

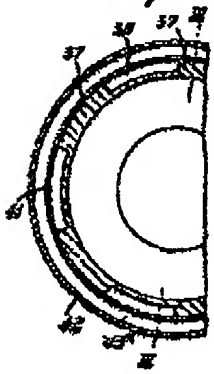
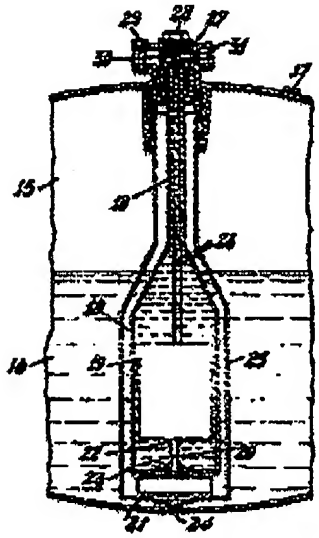


Fig. 2.



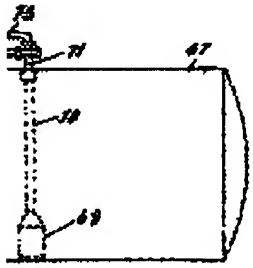


Fig. 3.